

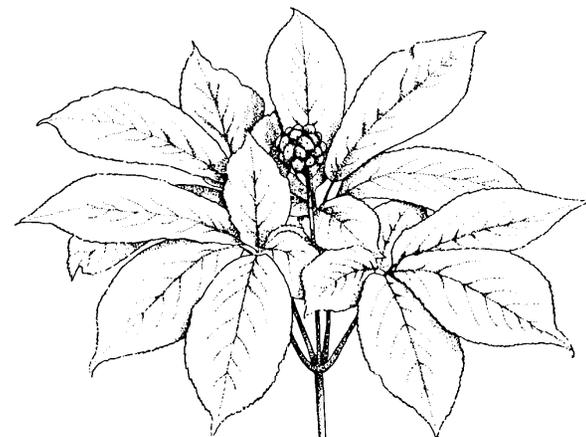


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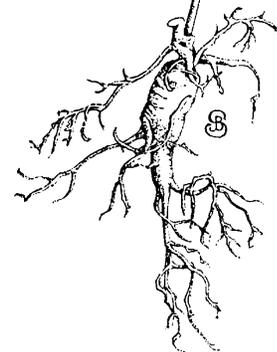
Published by:
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The Practical Guide to Growing Ginseng



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for Cornell University (ret.)

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Chapter 1

Introduction

So, you think you might like to grow some ginseng in your backyard or perhaps in a woodlot that you own or lease. Good idea! There is really only one way to be completely certain that the ginseng you eat has been produced under conditions that are acceptable to you. That one way is to grow your own!

In the last ten years hundreds of thousands of Americans have discovered the beneficial effects of ginseng and thousands of individuals have decided to try to grow some of their own. Unfortunately, ginseng is not really an easy plant to grow. At least, it is

not an easy plant to grow in quantity. It has rather demanding requirements for shade and other somewhat, unusual, environmental conditions. Under certain circumstances it is very susceptible to disease and other pest problems. It grows painfully slow requiring years to reach maturity and, quite often, it defies “conventional wisdom” that applies to almost all other cultivated crops.



In some ways it is necessary to “unlearn” much of what you may already know about gardening or growing crops when you begin to think about growing ginseng. You may be the best gardener on the block but a ginseng garden is unlike any other garden you may have tried. Ginseng is a unique and even a mysterious plant surrounded by huge amounts of folklore. Some of the folklore is true and some is nonsense. This plant absolutely refuses to be characterized by any hard and fast “rules” as to how it will or will not grow. For every “rule of thumb” you discover there will be a contradiction somewhere. If you talk with other growers you may find that what works for them does not work for you and vice versa.

My goal in writing this guide is to expand the production, use and knowledge regarding this ancient herb. I believe there is a tremendous potential for the development of an American ginseng industry that is supported by small scale producers throughout rural America. I believe that ginseng production may allow property owners to continue to own



Figure 16
Washing Roots

land that would otherwise have to be sold to pay the taxes. I believe that ginseng production may open our eyes and our gardens to other, alternative, agricultural commodities. Finally, I believe that small scale ginseng production can help to dispel the myth of conventional agriculture that “bigger is better.”

The following guide will teach you how to grow ginseng. I promise you that. If you follow these guidelines carefully you will be able to become self sufficient. You may discover other ways to accomplish the objectives I outline here without quite so much work. That is great but don't throw this brochure away. What works one time may not necessarily work the next time. I cannot guarantee that you will be able to make a lot of money by growing ginseng. One sure way to fail is to try to do too much, too soon. Avoid shortcuts, think small and be patient! ■



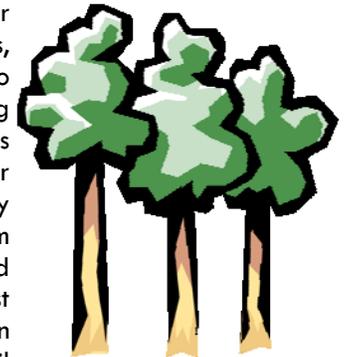
Figure 15
Human-Shaped Figure

Chapter 2

Preliminary Considerations

Before you begin to grow ginseng you must first decide why you are doing this. If your goal is to produce a reliable source of high quality ginseng root for your own consumption or for use by friends and families, read on. If you believe that ginseng is a worthless folk medicine that is useful only because it offers a quick fortune for anyone with a woodlot, forget it. Most people have goals that fall somewhere in between these two extremes. It is nice to have a hobby that may actually pay for itself or maybe even pay for your daughter or son's college education. It is also nice to have a challenge even if you are an expert gardener.

To grow ginseng successfully you need to mimic the conditions under which ginseng grows in the wild. Fertile, well drained, but moist, forest soil which has high levels of organic matter is ideal. At least 60 to 80% shade is required. Either natural shade from large, mature, deciduous trees or artificial shade from wooden lath or plastic shade cloth is sufficient. If your woodlot is full of pole sized, young trees, ginseng will not grow well due to competition. Ginseng is often found growing in forests of mixed hardwoods (deciduous trees) and evergreens such as white pine or hemlock. Pure stands of evergreens usually do not support ginseng stands beneath them due to extreme soil acidity (low pH) and competition from the shallow roots of most evergreens. A careful and honest evaluation of your forest type and a complete soil analysis can save you from many headaches in the long run.



While it is possible to modify an existing forest soil to make it more conducive to ginseng growth, this modification process is time consuming, fairly expensive and labor intensive. If your forest soil is unsuitable for ginseng production, you can still grow it in backyard raised beds. The advantage of forest cultivation is that once the ginseng is established there is really very little maintenance required. So called "wild simulated" ginseng is essentially ignored until harvest time.



Figure 13
Leaf Blight



Figure 14
Berry

Another important consideration is the time required to produce a harvestable sized ginseng root. Even under the most controlled and optimum growing conditions, such as would be the case in intensively cultivated raised beds, it takes three growing seasons at least to produce a root that is big enough to be worth drying. Since ginseng is planted the year before it begins to grow, the minimum time commitment is close to four years. It is possible to save time by transplanting one, two or even three year old roots into a prepared bed but the extra cost to buy these roots make it impractical except for situations where the grower wants quick results and is not overly concerned with costs of production.

One of the nicest things about growing ginseng is that the older the root becomes, the more valuable it is. The more years that it can grow happily in the woods, the more it is worth. Although the price paid for intensively cultivated three and four year old ginseng root has been steadily declining over the past ten years, the price paid for older, woods grown, root has been increasing each year. This is partially due to the fact that the root usually increases in weight each year and big roots are worth more than little ones. Ginseng roots also look slightly different each year as they age and their age is pretty easy to calculate by examining the scars on the rhizome which is located just above the main body of the root (Figure 1). Older roots bring more money than similar sized young roots. The active ingredients in ginseng seem to accumulate over time and somehow the people who buy ginseng have known this for decades. The highest prices paid for ginseng are for wild ginseng roots which usually average about twenty-five years old or even older. Some growers have been growing it for longer than that and they are able to get the same price as is paid for truly wild roots.

Of course the longer the crop is in the ground, the more likely it is that someone may find it and steal it from your woodlot. Ginseng thievery is a serious obstacle to forest cultivation, especially in the south. I have attended ginseng growing conferences in North Carolina in which this topic dominated the agenda. There are ways to secure one's ginseng patch from poachers. Most trespassers learn quickly which areas are patrolled regularly by landowners or the agents of the landowners and which areas are not patrolled. Some growers use barking dogs as alarm systems while others use more conventional alarm systems in addition to regular patrolling.



Figure 11
Blight



Figure 12
Rot



Figure 10
Slug Damage

The final consideration is how much work you are willing to put into this project. The easiest way to grow ginseng is to simply broadcast seed in a woodlot, rake some leaves over the top, and see what happens. This is also the least successful way to proceed.

Ten years ago I supplied fifty cooperators with about one ounce of seed each.(approximately 400 seeds) I told the cooperators to plant the seed in their woodlot without any specific instructions at all and let me know how it grew one year later. After one year only about five of the cooperators could find any ginseng at all and after five years only one had any ginseng growing.

For many years, each fall, I have been routinely planting ginseng seed in the woods where I hunt. When I return the following May I rarely succeed in finding any ginseng seedlings. Why? Good question! Apparently ginseng seed are relished by many, many creatures who live in the woods. Squirrels, grouse, songbirds, wild turkeys, deer, black bear, and white tailed deer are some of the creatures that have been reported to eat ginseng seed. Unfortunately, it is also true that not all woodlots are suitable for ginseng growth. So, unless your woodlot is devoid of wildlife and has suitable soil you might need to provide a little more effort in your planting plan. Later on I will discuss some ways of preventing the wildlife from eating your seed or roots. ■

Chapter 3

Ginseng Botany

Ginseng belongs to a family of plants called the Araliaceae. This family includes some pretty well known plants such as English ivy and schefflera. The genus of ginseng is *Panax* which is taken from the same Greek word as panacea. Panacea, of course, means cure all, a pretty good indicator of what the plant does. The species name of American ginseng is *quinquefolium*, which means five leafed. The leaves of mature ginseng plants are often divided into five leaflets. Therefore the Latin or botanical name of American ginseng is *Panax quinquefolium*.

Unfortunately, there are several other plants which are called ginseng. Asian ginseng is *Panax ginseng*, a legitimate type of ginseng that used to grow wild in Asia but is now virtually extinct. Today, Asian ginseng is widely cultivated in Korea, China and Japan. Siberian ginseng or Russian ginseng is *Eleutherococcus senticosis*. Although this plant is in the same family as ginseng it does not resemble either of the true species of *Panax*. There are also some other plants called ginseng that are not even distantly related to the two species of *Panax*. For purposes of this booklet I will describe the culture of American ginseng only. Asian ginseng may be grown in a similar fashion. American ginseng is far more valuable than its Asian counterpart.

Ginseng is an ancient plant dating back some 150 million years. It has evolved as an "understory" plant. An "understory" plant is one that grows in the shade of neighboring trees in mature forests. Its range is within the northern temperate regions of the world. It is referred to as an herbaceous perennial. An herbaceous perennial is a plant that dies back to the ground each year in the fall and produces new growth each spring from a dormant, underground bud.

In the United States wild ginseng is found only as far south as northern Georgia. In addition to requiring dense shade it also needs a period of cold temperature every winter in order to grow. This need for cold is referred to as a "chilling requirement." Many plants which grow in the northern latitudes have a chilling requirement including sugar maple and some other trees which lose their leaves each fall.

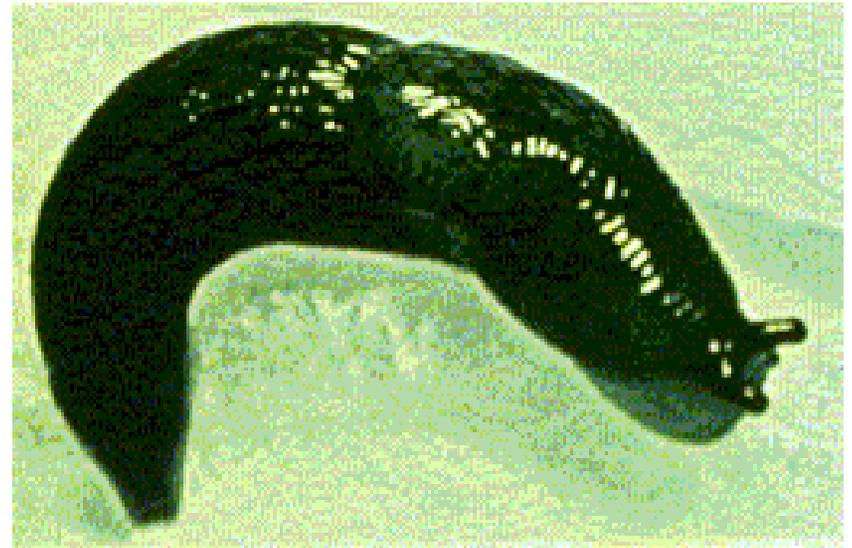


Figure 9
Slug



Figure 7



Figure 8

Ginseng is rather unusual in the fact that the young seedlings do not resemble the mature plants. Ginseng seedlings only grow about three inches tall with a single, three-lobed leaf (Figure 1). In the second growing season ginseng plants usually grow to be five or six inches tall and they produce two leaves with three to five leaflets each. In the third growing season they may grow to one foot tall with two or three leaves, each leaf having three to five leaflets (Figure 2). In the fourth growing season they may reach 18 to 24 inches tall with three, four or five leaves, each leaf having three to five leaflets. Thereafter the height and the number of leaves and leaflets, is determined by the growing conditions during the season. Any plant that has ample moisture, sufficient nutrients and optimum growing conditions will produce a large plant the following year. If growing conditions are good that next year then the following year it will also produce a large plant but if growing conditions are poor then the following year the plant will be smaller and stunted. It is not unusual for a ten year old or older plant to produce top growth that resembles a two or three year old plant.

The entire stem and leaves of a ginseng plant are formed within the bud that forms each year at the top of the root (Figure 3). When this bud opens in the spring the leaves and stem expand much like a fern frond unfolds from a bud. It is pretty easy to guess what the top of a ginseng plant will look like by examining the bud. Large buds will produce large stems and leaves. Sometimes ginseng will not produce any growth at all but will remain dormant underground for one or more growing seasons. I have heard stories of wild ginseng remaining dormant for up to ten years before it suddenly starts to grow again.

The root of the ginseng plant also changes in appearance from year to year. Even seedling roots show great variation in length and shape (Figure 4). As the plant grows and ages an underground stem called a rhizome grows progressively longer each year. As I mentioned above, the length of this rhizome is a good indicator of the age of the plant. Even the main body of the root changes in appearance as it ages becoming more wrinkled (Figure 5). The particular growing conditions at any given site also influence the appearance of the mature root.

Ginseng plants usually produce flowers and seeds in their third year of growth and every year thereafter. Three year old plants may only produce a half dozen flowers while vigorous four or five year old plants may produce as many as fifty. The tiny, white flowers are formed at the

top of a flower stalk that arises from the middle of the main stalk. The flowers are usually self pollinated although sometimes insects such as sweat bees may cross pollinate. Even if the flowers are prevented from being cross pollinated by covering them with a paper bag they still will form berries. After the flowers are pollinated they form green berries which ripen from the top of the round berry cluster to the bottom. The berries are a very pretty, bright red color when fully ripe (Figure 6). They are kidney shaped and usually contain two, white seeds within each berry. The pulp of the berries is juicy, fleshy and somewhat bitter. Some folks think the berries taste like soap but birds and other animals seem to enjoy eating them.

Ginseng seeds have a very complicated dormancy mechanism. It is sufficient to say that they usually require a year of underground storage after they are harvested before they are planted. People who gather wild ginseng are told to plant the berries within fifty feet of where they harvest the root to insure the continued existence of the particular patch. The seeds within the berries do not usually germinate until the second spring after they are planted.

Most ginseng growers will harvest the ripe, red berries, remove the seeds from the juicy pulp, mix the seeds with coarse sand and bury them underground for a year. The following year the seeds are dug up, the sand is washed away and the seeds are planted. Ginseng seeds that are not planted perish. They cannot be stored either frozen or dried.



Figure 5



Figure 6

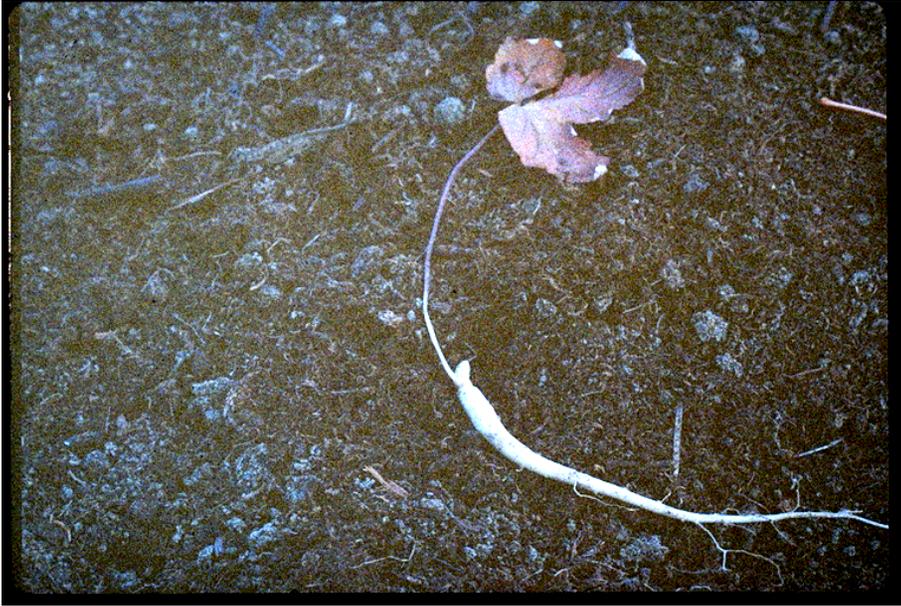


Figure 3

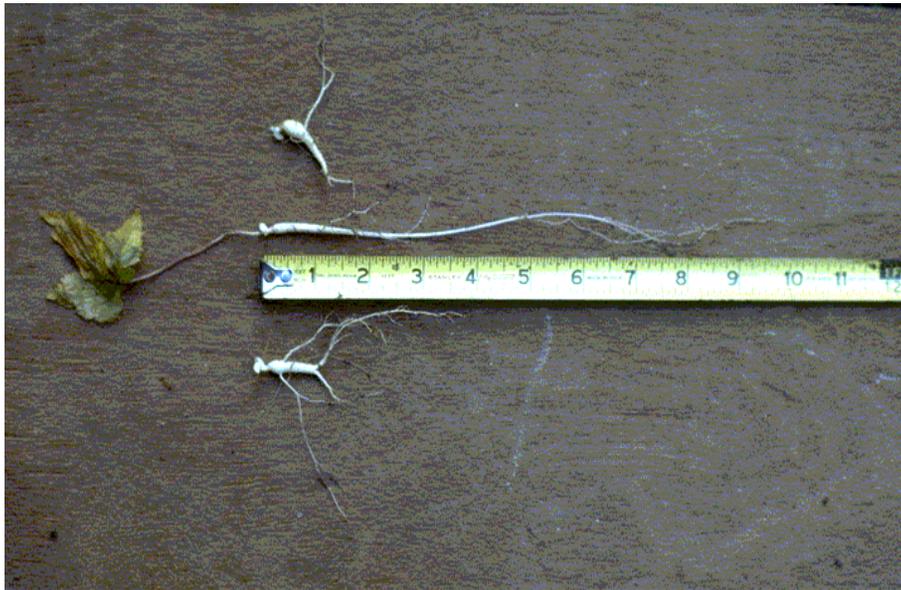


Figure 4

Chapter 4

Growing Ginseng in Backyard Raised Beds

The easiest way to grow small quantities of ginseng for one's own use is to make raised beds very close to your house where you can pay close attention to the plants. Three, four foot wide by twelve foot long beds, can provide you with an annual harvest of about one hundred roots weighing a total of at least six pounds fresh weight or two pounds dry weight. Ginseng roots lose about two thirds of their fresh weight when they are dried. The advantage to forming raised beds from scratch is that you can amend the soil to make it ideal for ginseng growth. Your own soil may or may not be suitable.

The best soil for growing ginseng is a fertile loam but any decent quality topsoil will do. Soils to avoid, if possible, have very sandy texture, also avoid soils from creek banks that are high in silt content and soils which have been dredged from the bottoms of ponds or wetlands. Don't purchase so called "spent mushroom dirt" or "mushroom compost" either.

Have the soil tested by your local office of Cooperative Extension. Almost every county in the United States has a Cooperative Extension office. For a small fee, (usually \$15 or less) they will send the soil sample to a university for a complete analysis. You may need the help of the local Cooperative Extension Agent to interpret the results of the soil analysis. For most cultivated crops the computer that interprets the soil analysis at the university will make recommendations for lime, fertilizer, sulfur etc. Very few, if any, university soil analysis computers include ginseng in their data bank. The recommendations will often come back blank. That's O.K. because I am going to tell you what is important and what is not. Ignore any recommendations for any crops other than ginseng.

The first thing to look at is the soil pH. This is a number between 0 and 14 that tells you how acid (sour) or how alkaline (sweet) the soil is. A soil that is neutral will have a pH of 7. Any numbers below 7 are increasingly acid and any numbers above 7 are increasingly alkaline. Garden limestone is used to raise pH and sulfur powder is used to lower pH. pH

itself is not an indication of soil fertility but if the pH is too low or too high certain nutrients may be chemically "tied up" and therefore not available to the plant. pH also influences disease causing organisms that live in most soils.

Wild ginseng is found in soils with a pH range of 3.9 to 6.5. The optimum pH for growing ginseng in raised beds is between 5.5 and 7.0 or, slightly acid to neutral. If you soil has a pH between 5 and 5.5 add five pounds of garden lime per 4 foot by twelve foot bed. If the pH is below 5, add ten pounds per bed, below 4, add twenty pounds of limestone per bed. Use regular garden lime or dolomitic lime, not hydrated lime or pelletized lime. If your soil sample has a pH of 8, add five pounds of powdered sulfur per bed, if 9, add ten pounds of sulfur, if over 9, add twenty pounds. If the pH is over 9.5 or below 3.5 find another source of soil!

Your soil analysis will also tell you how much phosphorous and potassium the soil contains and perhaps how much nitrogen. If the phosphorous levels are very low to low, add 2 pounds of superphosphate or 4 pounds of bonemeal to each bed. If the soil is very low to low in potassium add one pound of muriate of potash or sulfate of potash per bed. If the soil is low in both phosphorous and potassium you can use two pounds of 5-10-10 per bed.

If you are trying to grow ginseng organically you can substitute "natural" sources of both phosphorous and potassium. One organic source of phosphorous is bonemeal and you can substitute green sand for the potassium. Both of these products are readily available in most garden centers.

Wood ashes may also be substituted for lime at the rate of five pounds per bed but only if the soil pH is below 6.

The other important items are micronutrient and organic matter content of the soil. Both of these will be taken care of by adding either well rotted leaf litter from beneath maple trees or bales of peat moss purchased from a garden center. You will be adding a three inch layer of either of these materials to you beds to finish them off.



Figure 1



Figure 2

Panax Limited
7015 West Stewart Avenue
Wausau, WI 54401
(715) 845-5003

Sources of ginseng farming equipment and machinery (includes ginseng diggers, washing equipment, straw shredders, bed rakes, sprayers and tractors.

A & B Sales Inc.
8601 State Highway 107 N
Marathon, WI. 54448
(715) 443-2339 or
(715) 443-2634

Buetsch Implement Co. Inc.
2895 CTHS
Marathon, WI 54448
(715) 443-2276

Buyers of Ginseng

Sylvan Botanicals/American
Ginseng
Sylva & Scott Harris
P.O. Box 91
Cooperstown, NY 13326
264-8455

Bruce Phetteplace
Norwich NY 13815
(607) 334-4942

Bob Bolds
13721 Utley-Road
Waverly, KY 42462
(502) 533-6004

Hershey International Inc.
8210 Carlisle Pike
York Springs, PA 17372

Nature's Cathedral
(buyer of certified organic
ginseng)
1995 78th Street
Blairstown, IA 52209
(319) 454-6959

Hsu's Ginseng Enterprises, Inc.
P.O. Box 509
Wausau, WI 54402-0509

Wilcox Natural Products
P.O. Box 391
Boone, NC 28607

Now that I have told you what to add, here is how to go about this whole process. First buy or dig the soil which you have already had tested. To build three, four foot by twelve foot beds you will need a total of about four cubic yards of soil. (one yard equals 27 cubic feet) Have the soil dumped next to the area where you are going to build the beds.



Construct the beds using pressure treated lumber for framing. Don't worry about the chemicals from the pressure treated lumber contaminating your ginseng. Research has shown that the chemicals remain in the lumber and do not leach into the surrounding soil. Since the beds you build should last for at least twenty years or more, be sure to make them substantial by using 2 inch by 10 inch lumber and screws or lag bolts instead of nails. Raised beds have a habit of collapsing the frames that are meant to hold them if the frames are only nailed together (Figure 7).

This would be a good time to have a bed building party because it takes a lot of effort to shovel several yards of soil into the frames! Invite friends and neighbors to help out, each taking turns with the shovels. As you shovel the soil into the beds gradually work in the fertilizer and mix it in with a rake. When you have filled the bed to a depth of three inches add a one inch layer of peat moss or leaf compost on top and then rake it in. Add another layer of peat moss when the bed is six inches full then another when the bed is 9 inches full and work the peat moss in the entire bed. You should save another inch of peat moss or compost to top off the bed after the seeds are planted.

The best time to build these beds in during the summer. After they are finished allow the soil to settle for a few weeks. If rainfall is scarce water the beds with a hose a few times to fully moisten all the ingredients. Ginseng is almost always planted in the fall.

Don't wait until fall to purchase your seed or rootlets for transplanting. Be sure to purchase stratified seed. Stratified seed is seed which has already been stored for a year underground. Green seed is seed that has been harvested the current year. Green seed will not germinate next spring but will remain dormant until the following spring. Place your order during the summer to be sure you get what you want.

The price of ginseng seed varies tremendously from year to year. I have seen the price per pound vary from \$125.00 per pound to about \$30.00 or less per pound. At the end of this booklet there are sources of seed and rootlets. Quantities of seed that are much less than a pound will cost considerably more. The wide range of prices is due to the fact that ginseng seed is perishable and cannot be stored for an indefinite period. Bad weather conditions in any given year in a seed production region will reduce the amount of seed that is available the following year.

Ginseng seed is produced commercially in several major production areas including Wisconsin, Canada, several southern states and a limited quantity in New York and New England. The origin of the seed is not important, just be sure to purchase stratified seed! Stratified seed can be distinguished from green seed by looking for a white colored crack on the seam of the seed coat. During the year that the seed is stored underground the embryo, which is the immature plant within the seed, begins to grow and as it grows it swells and cracks the seed slightly. Many, but not all of the stratified seeds will show this characteristic.

There are approximately 6,500 seeds per pound and you will need about 500 seeds per four foot by twelve foot raised bed. When you receive your seed in the mail inspect it for molds or rotten seeds. Discard any moldy or soft seeds and store the rest in your refrigerator in a plastic bag. Some seed dealers will treat the seed with fungicides and insecticides while others will not. It is usually not necessary to treat the seed yourself. In fact, certain seed treatment chemicals may inhibit seed germination.

The best time to plant ginseng seed is right before a rain or snow shower but it may be planted anytime after the beds have settled. Waiting to plant until late fall may protect the seed from squirrels or other critters which may raid the beds. You can also put chicken wire over the beds to keep the critters out after planting. Form ten furrows in the raised bed, each furrow about an inch deep and about 12 inches from the furrow next to it. Plant fifty seeds per furrow with each seed about an inch from its neighbor. Cover the seed with an inch of soil or peat moss or compost and firm the planted bed with a piece of plywood. After the seed is planted your chores are finished for the winter.

the root has released all of its active ingredients. During the extraction process, clear liquor, such as vodka will turn golden in color. This ginseng fortified liquor can be flavored with sweeteners such as grape juice or maple syrup to suit one's own taste. The finished extract should keep indefinitely once bottled.

Many people who are already using ginseng consume it brewed as a tea. Much of the imported ginseng from Asia is marketed in this manner. You can certainly make your own tea by grinding up dried roots as you need them or you can dry the ginseng leaves in the fall and use them for making tea. Ginseng leaves also contain the same active ingredients as the roots. Be sure the leaves you dry are not covered with pesticide residues however before you dry them. Most of the commercially grown ginseng is sprayed almost weekly with several different pesticides during the growing season.■

Sources of seeds and rootlets for transplanting.

Sylvan Botanicals/
American Ginseng
Sylva & Scott Harris
P.O. Box 91
Cooperstown, NY 13326
(607) 264-8455

Bruce Phetteplace
Norwich NY 13815
(607) 334-4942

Tuckasegee Valley Ginseng
W. Scott Persons, Grower
Box 236
Tuckasegee, NC 28783
(704) 293-5189

Pickerell's Ginseng Farm
258 Ennis Mill Road
Hodgeville, KY 42748

Hsu's Ginseng Enterprises, Inc.
P.O. Box 509
Wausau, WI 54402-0509

Barney's Ginseng Patch
Rt. 2
Montgomery City, MO 63361
(314) 564-2575

Bob Bold's
RR 1, Box 118
Waverly, KY
(502) 533-6004
(seeds only)

Sources of artificial shade fabric:

Dayton Bag and Burlap
210 Dowdle Street
Algonquin, IL 60102
(312) 658-8488

Progenix Corporation
1013 North 3rd Avenue
Wausau, WI 54401
(800) 233-3356

Chapter 9

Suppliers of Seeds, Roots, Shade Cloth and Equipment

Not too many years ago ginseng cultivation in North America was limited to a single county in central Wisconsin and a few scattered, small patches in North Carolina, Kentucky, West Virginia and a few states in the Midwest. Suddenly in the late 1980's and early 1990's ginseng became one of the most popular herbs on the market. In 1996 it is estimated that some \$40 million was spent on imported Asian ginseng products and more than \$100 million in American ginseng products was exported. Along with this tremendous growth came the development of an industry to support the needs of the people who grow ginseng. The following list of suppliers is by no means complete, however, it does provide the novice with at least several sources of the supplies needed to grow ginseng.

Now that I have told you how to dry the root I must explain that you really do not have to dry it at all if you are only producing a small quantity for your own use. Freshly dug, dormant, ginseng root will keep for the whole fall and winter in your refrigerator in an open plastic bag or in the vegetable storage drawer. In fact the roots may actually sprout a new top while inside the refrigerator sometime around March in the year following harvest. Fresh or green root has a milder taste than dried root and it is much easier to chew. It may take a while but it is possible to develop a real liking for the taste of fresh ginseng root! Most people make awful, funny, faces when they taste it for the first

time but it really does grow on you after a while. To me, the fresh root tastes like earthy, slightly bitter, raw carrots.

It is also possible to preserve individual roots or parts of roots indefinitely in a 100 proof liquor such as vodka. For some reason 80 proof liquor does not work nearly as well. The roots begin to disintegrate within a year in the lower proof liquids. This type of procedure is called an alcohol extraction and much of the good stuff that is in the ginseng ends up in the liquor. This means that you can drink the liquor after a few months and replace it with new liquor. A total of three extractions lasting three months each can usually be accomplished before

The following spring the seedlings should sprout in late April to mid May. They will need to be weeded and occasionally watered if no rainfall occurs for a period of two weeks or more. The weeding is pretty important. Ginseng seedlings do not compete well with almost any kinds of weeds, especially grassy weeds. By eliminating the weeds early in the season, you will make your job much easier for the rest of the year and for the following years. Raised beds can be kept weed free much easier than ground level plantings.

The beds will also need to be shaded. If you build your beds directly beneath large trees the shade provided by the trees may be sufficient. Certain kinds of tree cast denser shade than others. Ginseng needs heavy shade as is provided by maples or oak trees. The filtered shade provided by locust or ash may not be sufficient.

To be on the safe side you can purchase plastic shade cloth from a garden center or from one of the sources I have listed at the end. Try to get shade cloth that casts at least 70% shade. Optimum shade may be as much as 85%. Position the shade cloth so that it protects the beds from sunlight on the south and west side as well as from above. Keep the shade at least three to five feet above the plants to allow for good air circulation around the plants.

Later on I will discuss some of the common pest problems that you may encounter but as a general rule, the first year seedlings are pretty much pest and disease free.

By late September the seedlings will start to turn yellow or even red as they go dormant. At this time you can gently lift the young plants to examine the root or to transplant it to another bed or a garden area. There should be a prominent, white colored bud on the top of the root where the leaf was attached.

Some of the seedlings may wither during the first growing season or they may keel over soon after they emerge from the soil. These should be removed from the bed at once. It is normal to lose 10 to 20% of the plants each year.

At the end of this first season you should remove about half of the plants to allow more room for the others to grow. Remove the smallest plants and transplant them to another bed or to a ground level location elsewhere.

Perhaps you can sell the seedlings to someone else who has caught the ginseng fever! Seedling transplants may sell for 25 to 50 cents each in small quantities.

The second season there will be fewer weeds to deal with but you may still lose 10 to 20% to "natural" causes. Once again water as needed. A good rule of thumb for watering is to make sure the plants get the equivalent of one inch of rain per week. Sink a coffee can in the bed to see how much water it takes to equal an inch and then apply this amount as needed. After the second growing season once again remove and transplant or sell about half the plants. Two year old transplants may sell for 50 cents each if they are large.

Since you started with 500 seeds per bed and have removed half of the survivors each year, by the third year there should be about 100 plants left in the bed. These plants will now have room to grow into good sized roots for the next two to three years. Three year old plants will also start to flower and produce seeds which you can sell or plant. If you are not interested in seed production you can cut off the flower stalks as they emerge from the stem each year which will make the root grow even faster.

Most of you may not want to wait for three years to harvest your first ginseng crop. If you build three raised beds you can plant one of them to seeds, one can be planted with 200 one year or two year old roots and the third can be planted with 100 two or three year old roots.

As soon as you harvest the third bed you may replant it with seeds or transplants from the other two. This technique insures a continuous harvest indefinitely. After three years of experience you will have a pretty good feel for the art of ginseng cultivation. This method is also the most successful for first time growers. You can carefully remove individual roots and replant only those which have a desirable shape or you can cull out the small roots and try to keep only the biggest most vigorous plants. I strongly encourage amateur growers to improve the genetics of ginseng by selecting only the very best plants for seed production. ■

the drying process. Since hot air rises the trays of roots are often shifted around with the top tray being moved to the bottom after a few days. The time required to completely dry the roots varies with the moisture content of the root at harvest time, the temperature of the air and the relative humidity in the building. It usually takes at least two weeks to properly dry the roots. At no time should the drying temperature exceed 95 degrees or discoloration is very likely.

Small scale or backyard growers can often dry their smaller quantities of roots in an attic or even a sunny windowsill in the early fall. I usually spread my roots out in shallow cardboard boxes lined with newspaper in the attic. The roots are inspected and turned almost every day until they are finished. If the weather turns cool, wet or rainy and the temperature in the attic drops below 70 degrees I resort to a drying box which I made from a plastic, foam type of cooler. A 15 watt light bulb provides adequate heat which I can adjust by letting in more or less cooler, outside air. I try to maintain about an 80 degree temperature in the box.

The appearance, if not the shape, of the ginseng roots changes as they start to dry. The roots will first shrink and shrivel as the surface moisture evaporates and the roots will become limp and rubbery. Be alert for any signs of mold or mildew. Remove any moldy roots and discard them or use them green. Mold may spread rapidly even as the roots are drying so it is important to inspect them often.

The roots are completely dry when they cannot be bent. They should break cleanly revealing a white interior. Dried ginseng roots are very light in weight requiring far more roots than you might think to make up a pound. Generally it takes about 50 to 100 really big roots, 100 to 180 medium sized roots and more than 180 small roots to make a pound by dry weight. Truly wild ginseng may require even more roots than this to comprise a pound but cultivated roots should not exceed these guidelines.

Once dried the roots may be stored in clean cardboard boxes or barrels away from any dampness. Dried ginseng roots will store well at room temperature as long as the storage area is not too humid. If the humidity is too high the roots will absorb moisture from the air and begin to rot. I have some dried ginseng in my office that has been in a cabinet for at least 10 years. Never store ginseng in plastic bags or other airtight container since the small amount of residual moisture within the root may cause it to rot.

is always easier to dig when the ground has good soil moisture, such as right after a substantial rain.

All ginseng roots have a main body called the taproot which is very variable in shape. Some roots really do resemble human forms with well defined "arms", "legs" a "head" and "neck". Sometimes the roots have even more anatomical detail being distinctly and obviously a male or a female figure. Often, these human figures appear to be in a particular position such as a running figure or a reclining figure. These human shaped roots are more valuable than others which have taproots that do not resemble the human form. (Figure 15)

In addition to the main taproot, which may even be comprised of several taproots joined at the neck, ginseng roots have many long, thin fibrous roots. These "fibers" may extend four to ten inches beyond the main taproot in any direction. Every effort should be made to carefully dig up the fibers along with the main body of the root. The extra effort required to dig the fibers will be rewarded with a higher price per pound when you sell.

After digging, the roots are usually washed lightly in a pail of water or hosed down with a strong stream of water. (Figure 16) The goal is to remove the surface soil but not to scrub away all signs of soil. If you are selling the ginseng to a dealer he or she may specify how much washing they prefer. Some buyers may prefer to buy the root unwashed and "green" (not dried). You can expect to receive one third the price per pound for green versus dried root. That means that if dried root is selling for \$120 per pound, you may receive between \$30 and \$40 per pound.

After washing, the roots are allowed to air dry and then they are slowly dried over a fairly long period of time. Never, never try to dry the roots in a conventional oven or a microwave.

Large scale commercial growers dry the roots in barns, sheds or other outbuildings using oil or gas fired heaters. The green roots are first spread out in a single layer on screens and the screens are stacked in a fashion that allows at least six inches of air space between layers of roots. The temperature is gradually brought up from about 70 to about 90 degrees. The lower initial temperatures prevent the outer surface from drying too rapidly which sometimes cause a discoloration. Fans are often used to move the air around. Good air circulation is crucial to

Chapter 5

Growing Ginseng in a Natural Forested Environment

Growing ginseng in the woods is a bit more complicated because you no longer have complete control of the environment as is the case with raised beds. You are, essentially, stuck with the soil that is there to begin with and you must deal with the normal inhabitants of the forest, including insects, slugs, diseases and critters.

In this situation the complete soil analysis is very important. If the soil is practically devoid of nutrients you can incorporate some fertilizer and some lime. Of course, it is difficult to till a forest soil since the trees get in the way and the shallow root systems of certain trees make hand digging nearly impossible. Some growers bring rototillers into the woods to prepare beds while others clear the area by hand.

Selecting the right spot in the forest to grow is also important. Avoid poorly drained areas that have standing water on them for any period of time. Look for places that have a slight slope to facilitate drainage.

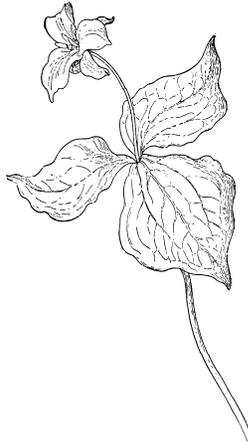
Avoid areas that were former apple orchards since apple trees are susceptible to some of the same diseases as ginseng. Avoid areas with dense, woody brush or patches of wild brambles such as raspberries. These areas are usually too sunny for good ginseng growth anyway.



Look for large, mature trees such as sugar maple, black cherry, butternut, tulip poplar, white ash, and basswood. An occasional white pine or hemlock is not a problem but don't try to grow in a pure stand of any type of evergreen. By "large, mature" trees I am referring to trees that are at least 15 inches in diameter or more than 45 inches in circumference. Trees this large cast dense shade that prohibits the growth of most understory plants.

Some plants growing on the ground which are pretty good indicators of suitable ginseng habitat include several species of ferns, mayapple, Lady's Slipper, Jack in the Pulpit, Baneberry, sarsaparilla, Dutchman's Breeches, wild ginger, Trillium or Wake robin, bloodroot, and, of course,

wild ginseng! Don't be put off if nothing at all is growing on the ground since this may just indicate a very shady area (Figure 8).



If your soil test tells you the pH is less than 4.0 you might want to find another place to grow. In general, soils with pH this low are also very, very low in nutrients. It is O.K. to add lots of nutrients to an intensively managed, raised bed system where you can carefully remove any and all plants that die but it simply does not seem to work that way in the woods.

Woods grown ginseng that is heavily fertilized seems to die out quickly due to diseases that spread far faster than you can keep up with. A forest planting also cannot have the optimum drainage that a raised bed provides. There are naturally occurring, disease causing organisms (pathogens) that live in the forest as well as natural microorganisms that protect plants from pathogens.

When you apply fertilizer in the woods, the result seems to be an increase in the pathogens and a decrease in the good microbes. If you insist on growing in an area that needs lots of fertilizer, start with a very small patch and see how it goes before committing yourself to a large planting.

The easiest way to identify a naturally fertile forest environment is to look at the plants that are growing there. A healthy stand of mature sugar maple is almost always found on good, fertile soil. Less desirable trees such as Black locust, ironwood, birches, alder, sycamore, willow and soft maple (red maple) , indicate either shallow soil, poor soil or wet soil. So called "pioneer species" such as trembling aspen, staghorn sumac and Norway maple are also not good indicators of a potential ginseng growing area. These trees grow where other, more desirable, trees will not and are not good companions for ginseng for a variety of reasons.

In the north, ginseng often grows in mixed hardwood forests containing sugar maple, black cherry, white ash, basswood, and an occasional butternut. In the south, tulip poplar and hickory are often associated with wild ginseng.

Chapter 8 Drying and Other Means of Preserving Ginseng

The vast majority of ginseng that is consumed on a worldwide basis is consumed as a dried product. Historically, dried ginseng root has been the only way this product has been marketed as an export from the United States. There are several reasons for this, the most important one being that drying is an effective way of preserving roots. Dried ginseng roots are very light in weight which makes shipping and handling relatively easy. As a general rule of thumb, three to three and a half pounds of fresh ginseng, when properly dried, will shrink down to about one pound.

Proper procedure for handling and processing ginseng roots begins at harvest time. Ginseng is almost always harvested in the fall when the roots have finished growing for the season. Fall harvesting also allows time for the berries to ripen so they may be replanted. The only time ginseng is harvested during the spring or summer is when a serious disease problem occurs such as root rot. Some growers will try to salvage a dying ginseng garden when heavy rain has created an outbreak of root rot. Hopefully your ginseng garden will not be afflicted with such serious problems and you may harvest in early October. The other advantage of harvesting in October is that you may carefully examine the roots and replant any that you wish to keep for breeding purposes. By October ginseng plants have gone dormant and may be transplanted quite easily.

In large scale, field operations, ginseng is harvested with a machine that is a modified potato digger. Most small scale growers harvest by hand using a digging fork or a hand trowel or sometimes even a pointed stick or a screwdriver. Folks who harvest wild ginseng have their own "special" digging tools which are usually homemade.

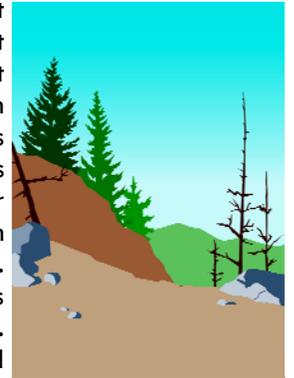
It is very important to harvest as much of the root as is possible without seriously damaging it. Buyers of ginseng root do not appreciate damaged merchandise and will pay considerably less for beat up roots. The soil where the ginseng is growing will determine how easy or hard it is to harvest. Loamy, stone free soil in raised beds makes for easy digging but rocky, hard clay soil makes the process a lot more work. It

the cost of production. I don't think backyard or forest ginseng growers can effectively sell seed for the price that growers using artificial shade can. Unless, of course, they are selling seed that is special!

One phase of "special" seed production that may have great promise in the future is to try to produce seeds that are disease resistant or seeds that have some other desirable genetic characteristics. This is one area where the hobby or backyard grower can have a profound influence. Since ginseng is primarily self pollinated, the offspring from one plant usually resemble and have similar characteristics as the parent plant. That means that if a parent plant has a particularly desirable root shape or grows fast and large or is resistant to certain diseases, the offspring might share those desirable characteristics. It will take years and years of research to prove this point but there is enough anecdotal evidence to convince me to practice some sort of selection process within my own garden.

I only harvest berries from my biggest and healthiest plants each year. I try to cut the flower stalks off the wimpy, little plants or even dig them up and destroy them. This is only possible in a garden where most of the plants are the same age. I also try to dig up a few healthy, vigorous plants each year when they have berries on them in order to examine the roots. I separate the seeds from plants with various shaped roots and try to see if the offspring share the same characteristic. Usually, they do! There are many, many other desirable characteristics that backyard growers can select for such as early flowering, numbers of berries produced and so on. I believe that during the past five years I have significantly improved my genetic base by this selection process. Large, commercial growers do not have the time or money to follow this procedure. ■

The slope or exposure of the site is not critically important. Although ginseng may be grown on north, east, west and south facing slopes, most wild populations are found on north or northeast facing slopes. Slight to steep slopes also support good growth but extreme slope makes cultivation difficult, if not impossible. Steep slopes also have great potential for erosion. A heavy rainfall could wash away small plants or create ditches if the land has been tilled to any extent. A slight slope is advantageous for facilitating both air and water drainage while perfectly flat areas may retain standing water and interfere with air circulation. It is also very important to avoid any area that is so windblown that fallen leaves blow away. Fallen leaves provide the essential mulch and nutrient supply that ginseng depends upon.



If your soil analysis indicates a naturally fertile soil as interpreted by your county Cooperative Extension agent, nothing needs to be added prior to planting. If the soil pH is low and the calcium levels are also low, add 50 lbs. of gypsum (Calcium sulfate) plus 50 lbs. of garden limestone per 1,000 square feet. If phosphorous and potassium levels are also very low, add 25 lbs. of 5-10-10 per 1,000 square feet.

If the organic matter level is below 5% it would be helpful to add a product such as "STEM" which stands for Soluble Trace Elements Mixture, according to the label directions. This is a collection of micronutrients such as zinc, molybdenum, manganese, boron and other elements that are needed in very low quantities compared to the micronutrients such as phosphorous and calcium which are needed in much larger quantities. STEM is not needed when soil organic matter levels are above 5% because forest soil organic matter usually contains ample supplies of these micronutrients. STEM is available from suppliers of greenhouse growing supplies.

Your County Extension Agent can interpret the micronutrient levels for you also since they are often included in the analysis.

The best time to plant ginseng in the forest is right before a snowfall, or as late in the fall as possible before the leaves fall. By this time many potential seed eating critters have hibernated or have finished storing

food for the winter. Newly planted ginseng seeds are eagerly devoured by critters of all sorts but mice, especially, will seek them out and eat them up.



A half dozen to a dozen mousetraps baited with peanut butter and placed near the potential growing area will give you an indication of the local mouse population. If you catch mice in the traps, continue to put out more traps and do not plant a single seed until you have wiped out the local rodents. Many, many forest plantings of ginseng fail to come up because mice eat the seeds soon after they are planted.

Of course ginseng seeds are also eaten by wild turkeys, grouse, and several songbirds as well as chipmunks. Late fall planting can avoid predation by many of these animals except for turkeys. Some growers actually fence off the area with four foot high chicken wire to keep the turkeys out. Although turkeys can easily fly over a four foot tall fence, they rarely do so unless they are startled.

Site preparation in the woods can be as simple as raking away the leaf litter and scattering seeds by hand or as complex as creating twelve inch tall raised beds in areas that have been completely cleared of all competing vegetation. Some growers will spend an entire summer prior to planting, clearing the area of all ground vegetation either by hand or by spraying some sort of non selective herbicide such as glyphosate (Round Up) . Others will bring in rototillers or other equipment for tilling the soil. Some will even bring tractors and backhoes into the forest for preparing the site.

Small trees or trees of undesirable species may be cut down and removed or used to frame beds that are then filled with surrounding soil. It is not wise to remove too many trees since the shade they provide may be essential for the ginseng to thrive. It is hard, if not impossible, to determine exactly how much shade is optimal within any given area without allowing excessive competition with the ginseng crop. Some growers remove almost all of the trees to make bed preparation and layout easier and then put up shade cloth to compensate.

There is no question that ginseng grown in extensively well prepared forest beds will grow faster and yield more per acre than ginseng that

The next year I attached a piece of wire to the top of the stratification box and then I wrapped the wire around a large stone to mark the exact spot.

Interesting things happen to the seeds during the winter storage period. The most important thing that happens is that the embryo continues to grow within the seed for a period of time until the ground is quite cold. This additional embryo growth often causes the seed coat to crack along it's seam revealing the white colored embryonic root. Ginseng growers refer to this crack as a "smile" and it is a pretty good indication that all is proceeding as it should be. Seeds that do not show this "smile" may be dead or they may still remain immature for another whole year and a half. Ginseng seed also changes color during the stratification period from a light tan color to almost black.

It is a good idea to leave the seed buried underground until just before you are ready to plant. Once the seed is dug up it may dry out and die. After digging up the seed box, the sand is washed away using a hose. Right before planting the seeds should be "floated" one more time. This time the liquid used for immersing the seeds should be a mild solution of household bleach. I use one cup of bleach to ten cups of water. This is a pretty strong disinfectant solution and the seeds should not be allowed to sit in it for more than 10 minutes. The bleach solution kills any pathogens that might still be alive on the stored seeds. Rinse the seeds one final time with cool, clean water, allow them to air dry and then store them in a plastic bag until you are ready to plant.

I know this sounds like a lot of work to ensure good seed survival but this system works consistently. As is the case with almost all aspects of ginseng growing, there are other ways of storing seed which may work just as well. Some growers don't even bother to remove the seeds from the berries. They simply bury the berries in a stratification box and float the seeds the following year. Most or all of the pulp has decayed and disappeared by then. I like to know fairly precisely how many seeds I have which is calculated by weighing them. A pound of seeds contains between 6,000 and 6,500 seeds or about 400 per ounce.

The price of seed varies tremendously from year to year as I mentioned earlier since the seeds cannot be stored indefinitely under any circumstances. As more and more acreage of ginseng is planted under artificial shade, the price of seed will continue to decline until it reaches

as soon as they turn a bright, cherry, red color.(Figure 14) I usually store the berries in a plastic five gallon pail for up to two weeks. If the weather is warm within a few days the berry pulp will start to ferment and decay. As the fermentation process continues the mass of berries will start to turn black and it will give off a pretty foul odor. After a couple of weeks of fermentation the berries may be removed from the pulp by flooding them with water. My usual procedure is to add a couple of gallons of clean water to the mass of berries and try to squeeze as many seeds out of the berries as is possible by hand. The berry pulp is then floated away by adding more water until the pail is overflowing. Viable ginseng seeds will sink to the bottom of the pail. Seeds that float usually will not spout anyway so there is no loss if some of them are floated away with the pulp. The process of squashing berries and floating off the pulp is repeated several times until the white seeds are fairly clean.

After this washing and floating process the seeds are spread out on a newspaper or piece of cardboard to air dry for a few hours. Do not let the seeds sit out in the sun and dry out for a few days because they may die if they are too dry before they go into the stratification box.

Stratification means storage in moist sand. Once the seeds are air dried they are mixed with coarse, clean sand in a ratio of one part seed to two parts sand. The seed plus sand mixture is then put into a box which has screen on both sides. This "stratification box" is then buried about 12 inches underground for the winter. The screen allows water to pass through the sand/seed mixture. This underground burial protects the seeds from extremes in temperature which might kill the seeds and it also prevents the seeds from drying out or remaining too wet which will cause them to rot. Unfortunately ginseng seed may be killed by temperatures of only a few degrees below zero.

Be sure to bury the box in a area that has well drained soil. The easiest way to determine the drainage is to dig a hole one foot square and one foot deep. Fill the hole with water and let it drain out. After the hole is empty, fill it with water again and see how long it takes to drain. If it drains within 30 minutes or less after the second filling, the drainage is o.k. If water remains standing in the hole for more than 30 minutes, find another spot to bury the seeds. It may sound trivial but it is important to carefully and precisely mark the spot where the seeds are buried. One year I spent the better part of four hours digging holes while trying to find the exact spot where I buried a box of seeds.

is wild simulated or planted in more or less natural conditions, however, the ginseng grown under natural conditions may be worth more when it is finally harvested. The potential grower has to weigh the advantage of faster, more uniform production with the higher price paid for "wild" looking ginseng.

Another consideration is the appearance of a well prepared forest site versus an undisturbed site. The prepared site may attract poachers whereas the wild site may not be as obvious. Most hunters of wild ginseng look for the characteristic red berries to alert them to the presence of a patch.

Intensively cultivated forest beds may also suffer from increased problems with insects and diseases due to crowding of plants and disturbance of the natural tree canopy. In natural settings tree roots and perhaps the roots from other vegetation may provide protection of ginseng from certain diseases. The processes involved in this phenomena are not well understood at all but there may be complex root-fungal interactions at work.

Depending upon the level of soil preparation you employ, seed may be planted individually in rows one foot apart with two or three inches between seeds in raised beds or it may be scattered more or less randomly on the forest floor. Whichever technique you select it is important to insure that the seeds are firmly pressed into the soil by walking on them. Deeper plantings of seed may fail to come up.

The newly planted area also needs at least two or three inches of mulch such as fallen maple leaves. If oak leaves are the dominant source of mulch, it would be helpful to shred them first since they tend to become compacted if left intact. ■

Chapter 6

Ginseng Pests and Diseases

A garden pest may be defined as "anything that interferes with the normal growth of a garden". When ginseng is grown in a garden it is subject to attack from all sorts of pests ranging from microscopic fungi to two legged poachers. It is possible that wild ginseng is also plagued by many pests in its natural environment leaving only the strongest survivors for the fortunate digger who finds them. It is also possible that the process of natural selection may have weeded out the weakest individuals over time, resulting in a wild population that is more or less resistant to most of the common pests that harass commercial growers.

Cultivated ginseng, regardless of where it is grown, is subject to many pest problems throughout its life. It is also subject to damage from chemicals and environmental conditions including weather. Ginseng plants that are grown under conditions of high density are much more subject to problems than plants grown under low density spacing. In many cases the incidence of disease appears to be inversely proportional to level of care. High density, field type gardens with artificial shade are more subject to diseases than wild simulated plantings or less crowded forest plantings.

It is also likely that synthetic inputs of fertilizers, soil conditioners and chemicals may predispose ginseng to insect or disease problems. Any plant that is growing under optimal conditions is best equipped to survive pest pressure however, no one really knows what "optimal" growth conditions are for ginseng. Therefore it is not possible to distinguish between "optimal" and "excessive" inputs of fertilizer.

Ginseng has evolved in a temperate climate. It is an understory plant that thrives in the shade of mature hardwood trees. It seems likely that the interrelationships between the ginseng plant and the microflora and fauna of its native environment are extremely important for resistance to pests. It is not just shade that is provided by and needed from the mature trees.

The best way to avoid disease and insect problems is to select a growing site that provides the conditions under which ginseng thrives in the wild. Unfortunately, such sites are not all that common and many are difficult to farm with equipment on a serious economic scale.

exclude all these animals with fencing however, plastic netting is available that will keep all birds away if it is properly installed. This type of netting is commonly used by berry growers to protect fruits such as strawberries, raspberries or blueberries. If small mammals, such as squirrels and mice, become troublesome, it would be best to eliminate them from the garden by a program of trapping or poisoning. Regulations regarding the use of poison baits vary from state to state. Growers should contact their local Cooperative Extension office for the latest information on how to control these animals. In addition many rural and suburban areas have individuals who are specifically licensed and trained by the Conservation Department to capture and remove nuisance wildlife for a fee.

Seed production usually begins during the third growing season but occasionally some vigorous plants will start to produce seeds in the second growing season. Seed production increases each year up until the sixth year when it levels off. Ginseng berries usually contain two seeds each but it is not uncommon for berries to have one or three seeds per berry. A three year old plant will produce five to fifteen berries containing a total of 10 to 30 seeds. Healthy four year old plants should produce ten to twenty five berries with twenty to fifty seeds and five year old and older plants may produce as many as 50 to 100 seeds. Seed production varies from year to year depending upon the growing season and the general health and vigor of the plants. My ginseng garden produced about three pounds of berries from about 700 plants in its third year, six pounds of berries in the fourth year and twelve pounds of berries in the fifth year. Three pounds of red berries will yield about one pound of seed (approximately 6,500 seeds). Therefore my 700 plants yielded an average of eight and a half seeds per plant in the third year, sixteen seeds per plant in the fourth year and thirty two seeds per plant in the fifth year.

Growers who are not interested in seed production or who cannot keep the critters from eating the seeds usually remove the flower stalk as soon as it is visible. This not only eliminates seed production but it also increases the rate of growth of the root since the plant does not need to divert energy into seed production.

In order to insure that the seeds will be viable it is very important to handle the berries properly from the time they are harvested until the seed actually sprouts about 18 months later. Berries should be harvested

Chapter 7

Seed Production and Stratification

Most, but not all, plants which produce flowers also produce seeds. Herbaceous perennial plants such as ginseng usually produce seeds in the fall which are capable of germinating either immediately after they are shed from the plant or, as is more common, the following spring. Once again, we find that ginseng does not fall under the "usual" category. Ginseng plants do indeed flower in mid summer and seeds are produced within fleshy berries which change in color from green to pink to bright red. Seeds harvested from green berries are immature and will never germinate. Seeds harvested from red berries are capable of growing but they are still immature. This is because the "embryo" or baby plant within the seed is not yet fully developed. This is why ginseng seed does not usually come up the following spring.

As I mentioned above in the chapter on ginseng botany, most growers harvest the red berries in September. Some berries actually turn red as early as mid-August and others may not turn red until late September, therefore growers who wish to maximize seed production begin harvesting the berries just as soon as they start to turn red and continue harvesting at least twice a week until all the berries are harvested. This is particularly important in forest gardens where wild animals may be eating the berries before you can gather them.

Mice are especially fond of ginseng berries and will greedily consume them even before they begin to turn red. If you are trying to grow your own seeds it is very important to eliminate mice before the plants begin to produce berries. A conscientious program of mouse trapping may be required for a forest grower to obtain any seeds at all!

Wild turkeys are also very fond of ginseng berries but they usually wait until the berries turn red. A three or four foot tall chicken wire fence is often sufficient to keep wild turkeys away from the berries. Although wild turkeys are excellent flyers, they rarely fly over a three foot tall fence if they can walk around it. If no other food is available however, turkeys will fly into a ginseng garden and eat all the berries.

Gray and red squirrels, ruffed grouse, chipmunks and several songbirds may also eat ginseng berries and seed. It is very difficult to effectively

Most growers today rely on pesticides to control problems. In New York State there are only a relatively few pesticides available for use on ginseng. In other states there may be none at all. It is illegal to use any pesticide on any crop that is not specifically included on the label of that pesticide. Growers are urged to obtain and study a complete label for any pesticide that they consider using on ginseng.

It is also important to note that pesticide registrations change frequently and what is legal and recommended on one day may be illegal the next. Generally, a product may continue to be used according to its label directions until it is used up.

I will now list and discuss the more common pest problems associated with the cultivation of ginseng beginning with seed handling and ending with post harvest problems. The use of specific brand names of products does not constitute any endorsement of these products.

Problems Usually Encountered in Year One

- 1) Dead seeds or seeds failing to germinate is usually a result of improper seed storage and stratification. Ginseng seed is highly perishable from the time the berries ripen until the time the seed germinates.
- 2) Seeds being eaten after planting but before germinating may be due to wireworms, especially in areas previously occupied by grasses. Wireworms are the immature stages (hard bodied caterpillars) of several species of beetles. Several formulations of the chemical pesticide diazinon are legal for use as a preplanting or post planting soil poison to kill any insects that may eat the seed. Ginseng seed is also occasionally attacked by slugs just as it germinates. Several brands of slug poison are available and legal to use on ginseng in most states.
- 3) Damping off of seedlings is a disease that can be caused by several different fungi commonly present in most soils. Patches of seedlings that collapse and die soon after they come up are characteristic symptoms of damping off disease. Close examination of the dead seedling will show a narrow constriction of the stem near the soil level or an apparently healthy stem with a discolored or rotted root.

Cool, wet weather at time of germination and heavy straw mulch contribute to damping off problems. Avoid shading the seedlings until they are up and growing and limit straw mulch to an inch or so deep for seedlings.

- 4) Slugs are serious pests of ginseng at all ages but they are especially troublesome on seedlings where loss of the leaves early in the season usually means loss of the plant.(Figures. 9, 10) Unfortunately slugs thrive under the same conditions that ginseng is grown in fields. Forest plantings usually have few problems with slugs, perhaps because of the many critters in the woods which eat them! Slugs hide by day under moist straw, rocks, boards or vegetation and emerge at night to devour leaves, stems, berries and sometimes seeds. Sawdust or bark mixed with sawdust as a mulch may deter slugs. There are also many home remedies ranging from beer in a saucer (slugs love beer and will crawl into a saucer and drown) to dusting the soil with wood ashes to trapping using grapefruit halves or wooden boards. Most commercial growers rely on poison slug baits or pellets. There are several different types of commercial slug poisons sold at Garden Centers and Farm and Home Stores.

- 5) Sunburn is a problem caused by too much exposure to direct sunlight. Symptoms include brown leaf margins, cupped leaves with tan or brown margins and premature death of the leaves. Ginseng seedlings can usually tolerate direct sunlight early in the season but should have shade provided within two weeks after they come up. Sunburn damage does not show up on the plants until several weeks after the damage has occurred.



- 6) Spindly, (tall, thin plants) or small seedlings may be caused by competition from weeds. Ginseng does not compete well with weeds. Eliminate them before planting and keep the garden weeded during the growing season. Be careful not to disturb the ginseng seedlings when pulling up weeds.

Proper identification of the pest organism is crucial to successful management. Consult your local office of Cooperative Extension for up to date pest control information if you have problems. ■

drenches or treatments with conventional fungicides have proven ineffective.

- 5) Cutworms cut down ginseng plants at the soil level. These gray caterpillars (about 2 to 3 inches in length) are active in the evening and can be very damaging to a stand of ginseng. Cutworm damage can be distinguished from slug damage by the present of cut off leaves or stems lying intact on the soil surface. Slugs eat the leaves, they do not cut off the plant at ground level and leave it lying on the ground intact. Cutworms can be killed by drenching the soil with an insecticide.
- 6) Leafhoppers are small, wedge shaped, usually brightly colored insects which hop quickly when disturbed. They feed on the leaves causing small, discolored spots, which is usually not serious.
- 7) Aphids or plant lice either feed on the underside of leaves causing them to cup or curl or they may feed at the base of seed heads, seriously interfering with seed production. These and other insect pests can be killed by timely applications of insecticides such as diazinon or pyrethrum when problems are encountered. Few insects do enough damage to require spraying except for wireworms, cutworms, and plant lice.
- 8) Other pests include wild turkeys and gray squirrels which eat berries, seeds and occasionally scratch up and eat small roots. Mice or voles will often tunnel under straw mulch and eat roots, mice will also eat seeds and berries as they ripen. White tailed deer will occasionally eat a few leaves but do not seek out ginseng as a preferred food. Cattle, sheep, goats and pigs can devastate a ginseng garden if they get in. Dogs can trample down beds and horses can ruin beds in a hurry. Most large animals can be kept out of gardens by fencing. Human poachers can be a serious problem in forested locations too.

In summary, ginseng root rotting diseases can easily destroy a garden in a very short time period. Leaf diseases will reduce yield and may eventually destroy a garden but, in general, they can be managed by spraying with appropriate fungicides when necessary. Slugs are a constant problem in many artificially shaded gardens but often are completely absent in forest gardens. Wild animals can be serious in forest gardens but usually only eat the seeds.

Problems Often Encountered in Ginseng Plantings that are Two or More Years Old

- 1) Slugs and sunburn can damage ginseng at any age. Two year old and older plants should have shade as soon as they come up in the spring. In the forest, nature provides the shade but gardens with artificial shade or backyard beds should have shade cloth in place before the plants emerge in late April or early May. Slug control is an ongoing battle that lasts the life of the crop although larger, older plants can tolerate more damage than seedlings. It is easy to determine if slugs are present by setting traps made of grapefruit halves. Set the grapefruit halves near the ginseng plants, cut side down and look under them the next morning. If slugs are present they will be found in the grapefruit. This type of trapping may significantly reduce the number the slugs you have to deal with. It is also helpful to go out at dusk when slugs become active and search for them. A few grains of ordinary table salt from a salt causes slugs to dissolve into yellow goo in just a few seconds. Kids seem to find this phenomena fascinating. Perhaps you can coax your kids into being "slug hunters" for you!
- 2) Alternaria leaf and stem blight caused by the fungus Alternaria panax is the most common disease of cultivated ginseng. Areas of the leaves and stem attacked by this fungus, called lesions, are visible soon after they are infected. On stems, light brown to dark brown lesions (spots) eventually encircle the stem causing it to bend over and die. On leaves the brown spots are often circular but sometimes they are wedge shaped. The tan or brown spots are often surrounded by a yellow halo (Figure 11). Infectious spores are produced in these brown areas and may spread the disease rapidly during hot, wet, weather. Depending upon time of infection, weather conditions, and air flow, Alternaria blight may wipe out all the foliage of an entire ginseng garden although roots usually survive but are much stunted in growth. Woods grown ginseng is usually less affected by Alternaria blight due to better air circulation, cooler temperatures and lower humidity. Alternaria is usually most serious in crowded, raised bed plantings.
- 3) Phytophthora root rot is, by far, the most serious disease of cultivated ginseng. It is most common in crowded three and four year old gardens under artificial shade where it can be devastating during

wet weather, especially if water drainage is poor. phytophthora is spread by water and generally moves downhill to low spots in the garden. As the disease spreads it can kill acres of gardens within a few days if conditions are right. The first symptom of phytophthora is a plant that is wilting at a time when there should be no water stress to cause the wilting. The leaves of infected plants sometimes turn yellow or red as they normally do in the fall prior to dying back to the ground. When you dig up the infected plant, the roots will appear beige and rubbery instead of white and brittle. Soon the infected roots turn mushy and disintegrate rapidly. Eventually the entire root will disappear completely, leaving the soil contaminated with infectious spores.

Roots that are harvested during the early stages of infection may appear normal but after drying they will show an obvious gray to black colored discoloration which reduces their value considerably (Figure 12). The phytophthora fungus also causes a leaf blight that is similar to Alternaria. It can be easily distinguished from Alternaria in its early stages because its initial symptoms occur as dark-greenish-black tissue on the leaves (Figure 13). Infected leaves appear as though they are water soaked but may later turn tan colored, papery thin and nearly translucent. There is no yellow halo present surrounding the lesion as it common with Alternaria. Foliar phytophthora is managed much the same as phytophthora root rot.

Management of Phytophthora Root Rot and Leaf Blight

- [a] By far, the best way to manage this disease is to prevent it from getting established in your garden in the first place. Ginseng should never be planted in fields that had ginseng growing there previously because the infectious spores of the disease may remain alive in the soil for an indefinite period of time (at least 75 years). Some growers also avoid areas where apple trees have grown previously because the same fungus also affects apple trees. Alfalfa is affected by a different type of Phytophthora which does not attack ginseng.
- [b] If the disease is limited to a small area within a garden, remove diseased plants along with a one foot border of apparently healthy plants to limit the spread of the fungus. Sterilize the soil in the affected area by drenching with a solution consisting of one cup of household bleach in a

gallon of water.

- [c] Sanitation is extremely important since the disease may be spread on contaminated soil from one field to another. Tractors, sprayers, boots and even hand tools such as rakes should be cleaned and sterilized with a solution consisting of one cup household bleach per gallon of water. Hose down all larger machinery with a strong stream of water and let it dry thoroughly before entering the gardens.
- [d] Choose a well-drained soil for your garden site and make raised beds to further improve the drainage. Avoid any areas that have standing water present after a heavy rain. Try to avoid compacting the soil with equipment or foot traffic which inhibits drainage. Incorporate forest humus or other finished compost, especially bark or wood chip compost into the raised beds. There is some evidence that certain composts may supply beneficial soil microbes that suppress phytophthora disease.
- [e] Chemical control: Soil fumigation before planting is effective for only a very short time, therefore, it is not recommended. There are several fungicides for controlling phytophthora disease including Ridomil 2E, Subdue Granular fungicide, and Alliette fungicide. Follow label directions for rates and timing of applications. Also make sure these chemicals are legal to use in your state.



- 4) Rusty root refers to an orange or rust-colored discoloration of the ginseng root that may eventually cause the entire root to rot away. This disease is probably caused by the fungus called Rhizoetonia. This rot can start anywhere on the root. Rotted areas are dark, reddish brown, firm, dry and never mushy. Affected plants may fail to come up in the spring or may show premature fall coloration as is seen in phytophthora root rot, especially during hot, dry weather. Unlike phytophthora, which is more common on older roots, rusty root infects seedlings as well as older roots. Sometimes the rusty discoloration is limited to a small portion of the root which sloughs away when washed prior to drying, leaving a hole or a gash in the root. Since no one is certain which fungus or combination of fungi causes rust root, no control recommendations are possible. Soil